to read very carefully to discover just what the theory actually consists of.

Generally this is a well-written essay, good for students, which can also be read with profit and pleasure by their professors.

WALTER F. CANNON
Smithsonian Institution

D. K. C. MacDonald. *Faraday, Maxwell, and Kelvin.* (Science Study Series.) xvi + 143 pp., 45 plts., index. Garden City, N. Y.: Doubleday (Anchor Books), 1964. $1.25 (paper).

This contribution to the biographical literature of Faraday, Maxwell, and Kelvin is in many respects a charming book which, however, falls far short of achieving the author's hope, as expressed in the preface (p. x), of making "something more than cardboard figures of these men."

The primary value which this work holds for historians of science probably inheres in the collection of plates with which the late Dr. MacDonald enhanced his rather personal and informal style. Represented in the forty-four pages of photographic plates are the following: two portraits each of Faraday, Maxwell, and Kelvin plus one of Davy; scientific apparatus associated with certain of the original contributions of each of these investigators; signatures of each; examples of the scientific writing and correspondence of Faraday, Maxwell, and Kelvin; various residential and institutional buildings occupied by these three men, and more conventional memorabilia such as gravestones, commemorative plaques, and stained glass windows.

As is clear from both his introduction and the fact that this book is in the "Science Study Series," MacDonald was not principally interested in addressing historians of science. It may be well, therefore, to consider his book in terms of the students and general public for whom the volumes of the series are intended. The choice of this audience involved MacDonald in the Herculean task of considering fundamental contributions to nineteenth-century physics by means of elementary and qualitative scientific concepts which are woefully inadequate. The diffuseness suggested by the variety of subjects depicted in MacDonald's plates is equally exhibited by his text which consists of an assemblage of vignettes. This style is admirably suited to the personal and informal nature of MacDonald's approach to Faraday, Maxwell, and Kelvin, but, coupled with the difficulties implicit in his choice of an audience, it is also largely responsible for the failure of his book to develop three-dimensional characterizations of these men.

The consideration of a single vignette will perhaps suffice to suggest both the charm and the failing of this book. Following his sketch of Maxwell's contributions to kinetic theory, statistical mechanics, and thermodynamics, MacDonald refers the reader to two of his plates. The first is of a postcard which Maxwell sent to Thomson, who subsequently initialed it in noting that it was not to be discarded. It exhibits two significant signature abbreviations: Maxwell's dp/dt which, as MacDonald pointed out, derived from the contemporaneous notation for one of the thermodynamic relations, i.e., $dp/dt = J\,C\,M$; and Thomson's, i.e., Lord Kelvin's, K. The second plate is a photograph of a model which Maxwell constructed of the thermodynamic surface of water.

One-half of the two pages of text (pp. 76–78) of this vignette is given to a general, qualitative, nonhistorical discussion of an elementary kinetic theory of matter. In the single page devoted to Maxwell's contributions, MacDonald could only suggest what statistical mechanics is, and claim, first, that "Maxwell and . . . Boltzmann . . . laid much of the foundations of statistical mechanics with their theoretical studies of gases . . ." and, finally, "that if Maxwell had done nothing else in his life but contribute to the discovery of this particular [Maxwell-Boltzmann distribution] law, it would have been an adequate monument. . . ." As sound as these claims are they do not ring

true in context; rather, they appear grandiose when considered in terms of MacDonald's juxtaposed kinetic theory involving such descriptions as "molecules belting around at rather high speeds. . . ."

This sketch, rich in certain details, remains two-dimensional simply because of its not having been cast within the scientific context out of which developed the contributions it purports to relate. Similarly the composite delineation of Maxwell (or Faraday or, to a slightly lesser degree, Kelvin) by vignettes like this necessarily lacks depth. Engaging though many of these vignettes are, the figures of the men which they portray emerge as cardboard collages.

J. BROOKES SPENCER
Oregon State University

Alfred Romer (Editor). *The Discovery of Radioactivity and Transmutation.* With commentary by the editor. (Classics of Science, Vol. 2.) xi + 233 pp., 7 illus., figs., index. New York: Dover, 1964. $1.65 (paper).

Like many other areas of modern science, the history of radioactivity has largely been neglected by contemporary historians of science. Yet, what this subject may lack in quantity is amply made up by the quality of Professor Romer's books. The volume under consideration is the outgrowth of a more elementary treatise on the development of radioactivity, entitled *The Restless Atom*, which appeared as part of the "Science Study Series." Now, the author has combined a perceptive narrative with sixteen important papers reprinted from the first decade of this science.

Radioactivity was discovered by physical means and the phenomenon was investigated for many years primarily through physical studies. Thus, the properties of the rays, the decay periods of the radioelements, and indeed the concept of a genetic series of transmutations were based in great part on physical research.

This aspect of radioactivity is the subject of this book, beginning with a series of four papers written in early 1896 by Henri Becquerel (all translations into English are by Romer), and ending with Ernest Rutherford's well-known Bakerian Lecture of 1904, "The Succession of Changes in Radioactive Bodies." While, of course, physical work in radioactivity continued after this date, Romer has chosen to end his study here because the central developments in this science now took a chemical turn.

The Becquerel papers describe the discoverer's mistaken first impression that the radiation was a form of phosphorescence and his gradual realization that the source of the rays was the metallic element uranium. Despite his own discoveries to the contrary, Becquerel persisted in his belief that the energy of uranium was due to some form of phosphorescence. Following this section come two papers by Rutherford, the first in which he announced the discovery of what appeared to be a radioactive gas and which, "as it will be termed for shortness" (and obscurity), he called *emanation*. From measurements of the changing activity of the emanation and its active deposit, Rutherford was led to an understanding of the half-life of the radioelements, and this characteristic ultimately led to the theory of transmutation.

Aside from a paper by Sir William Crookes, in which are discussed various sources of radioactivity and a uranium compound strangely made inactive, and two papers on the energy of these active bodies — one by Rutherford and Frederick Soddy, the other by Pierre Curie and Albert Laborde — the remaining reprints in this volume deal with radioactivity as the sign of a transmutation and the proof of this theory. In large part this was the work of Rutherford, Soddy, and William Ramsay — Soddy collaborating first with one, then the other. The experimental basis for the theory, and its formulation, were products of Montreal, but the single piece of irrefutable, confirmatory evidence, showing that helium had evolved from radium, was gathered in London.

Besides a short introduction, Romer